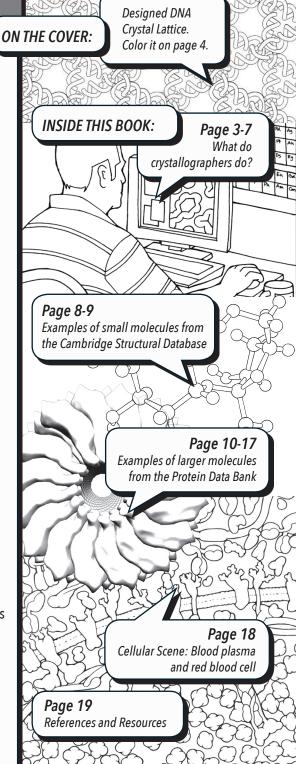


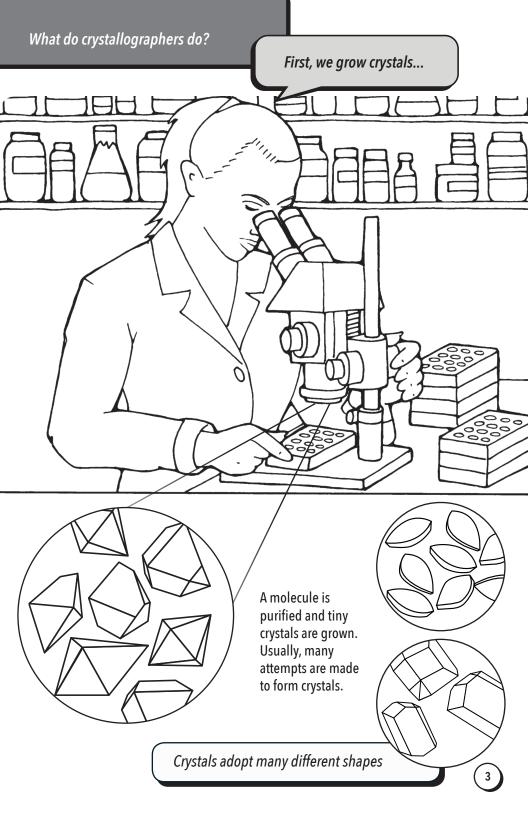
Discovering Biology Through Crystallography

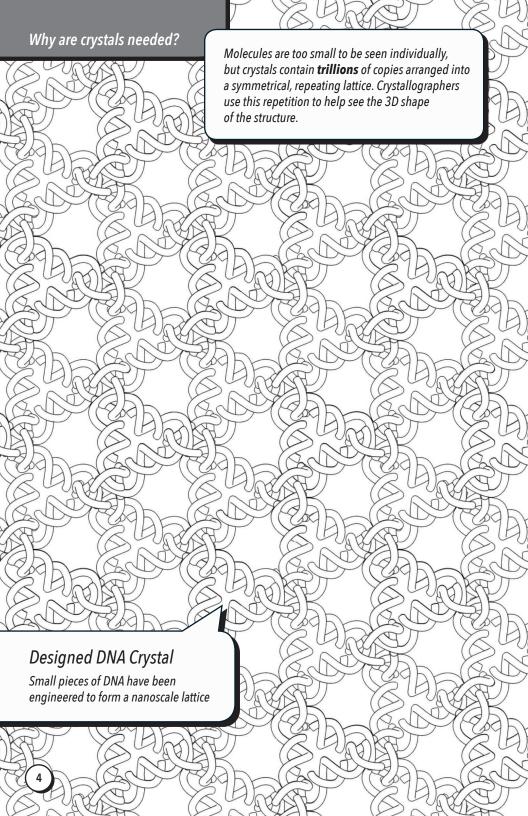
Crystallography is the study of atomic and molecular structure. Crystallographers want to know how the atoms in a material are arranged in order to understand the relationship between atomic structure and properties of these materials. They work in many disciplines, including chemistry, geology, biology, materials science, metallurgy and physics. Crystallographers study diverse substances, from living cells to superconductors, from protein molecules to ceramics.

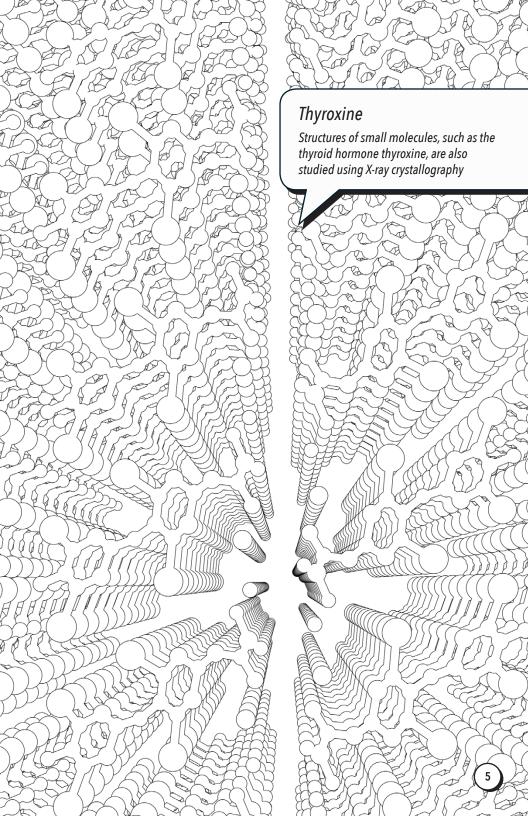
This book focuses on the diverse 3D shapes and functions of biological molecules studied by crystallography. Crystallographers make their 3D structure data publicly available in online resources like the Protein Data Bank and the Cambridge Structural Database. This broad access helps researchers, educators, and students around the world better understand biology and medicine.

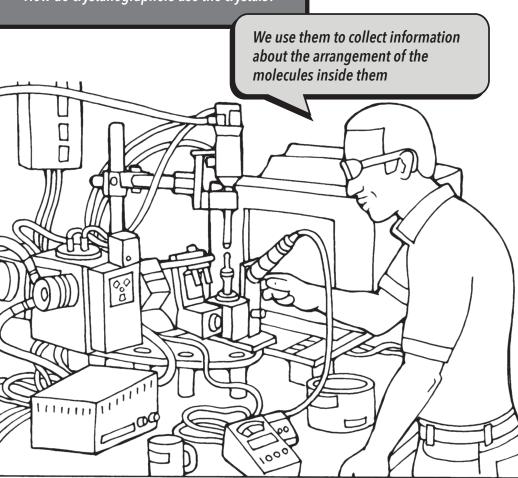
Crystallographers also work together in strong communities. The American Crystallographic Association (ACA) is a non-profit, scientific organization that promotes interactions among scientists who study the structure of matter at atomic (or near atomic) resolution.





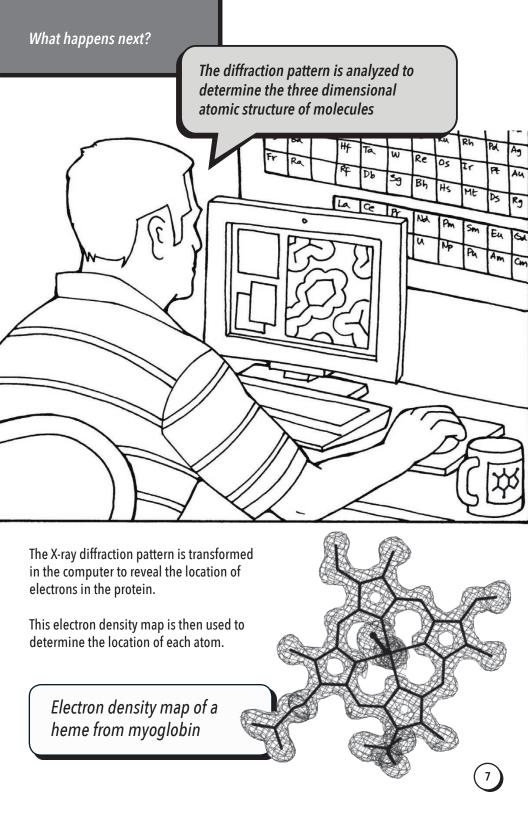




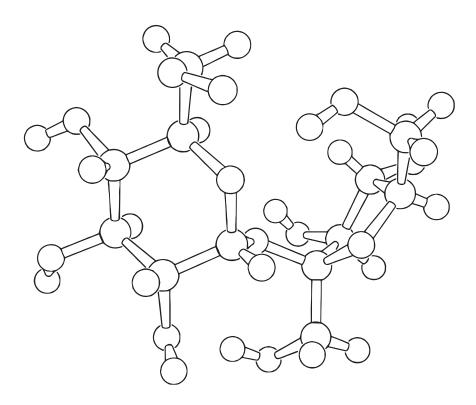


The crystals are placed in a beam of X-rays, which are diffracted by the molecules inside them into a characteristic pattern of spots

X-ray diffraction pattern of a DNA crystal



Small molecule crystal structures like these are available in the Cambridge Structural Database (CSD). Learn more at **ccdc.cam.ac.uk**

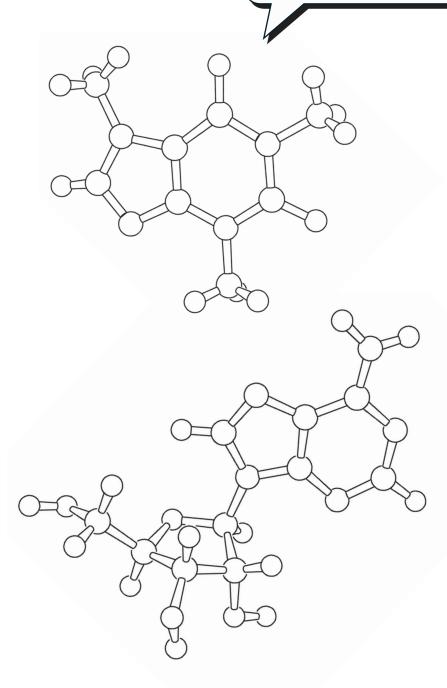


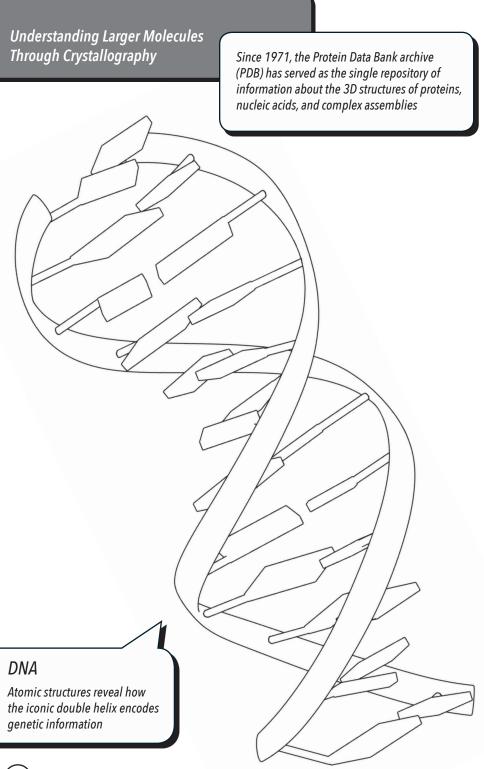
Sucrose

Sucrose is the sweet molecule in table sugar, composed of glucose (left half) attached to fructose (right half)

Caffeine and Adenosine

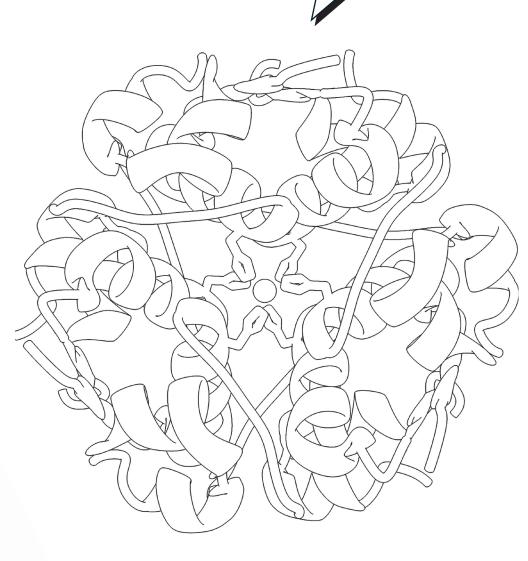
Caffeine (top) mimics the shape of adenosine (bottom), blocking receptors for adenosine in the brain that are involved in drowsiness



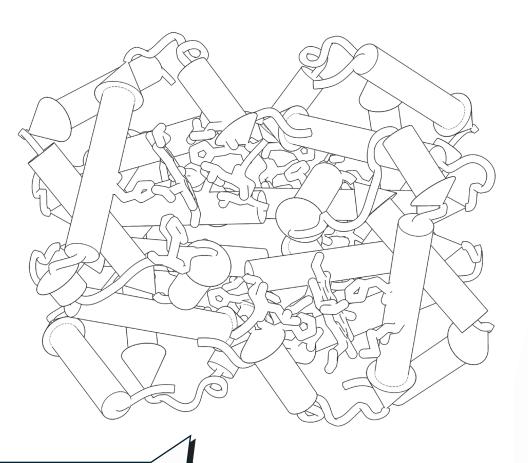


Insulin

The hormone insulin helps control the level of glucose in the blood



The Worldwide PDB (wwPDB) organization manages the PDB archive and ensures that the PDB is freely and publicly available to the global community

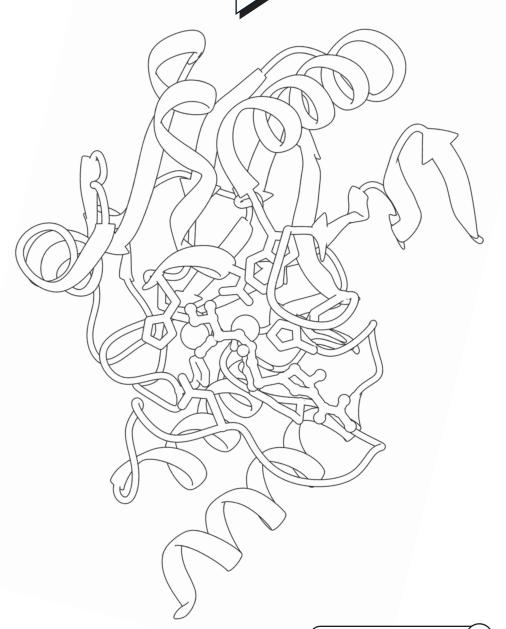


Hemoglobin

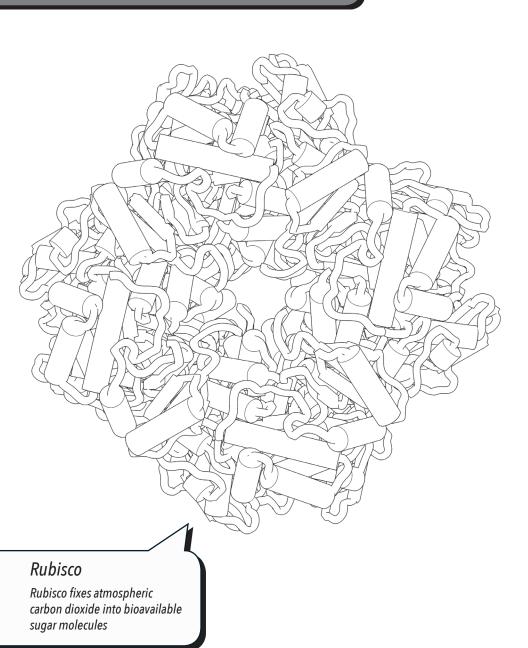
Hemoglobin carries oxygen from the lungs to the body's tissues

New Delhi Metallo-Beta-Lactamase

This enzyme is found in some superbugs that inactivate a wide range of penicillin-like antibiotics

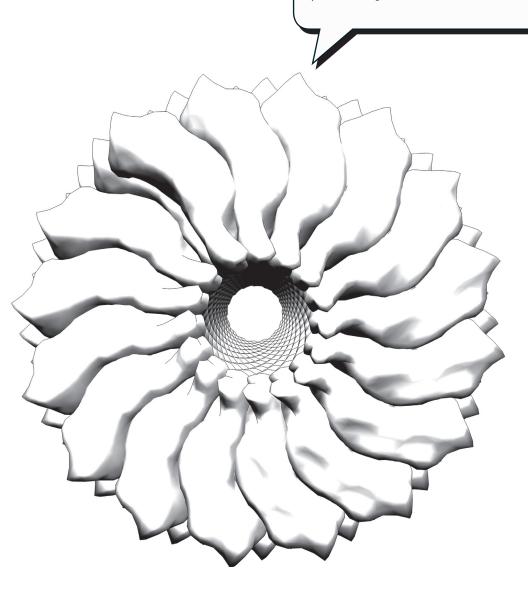


Crystallography provides an important look into the biology of all living things, including plants



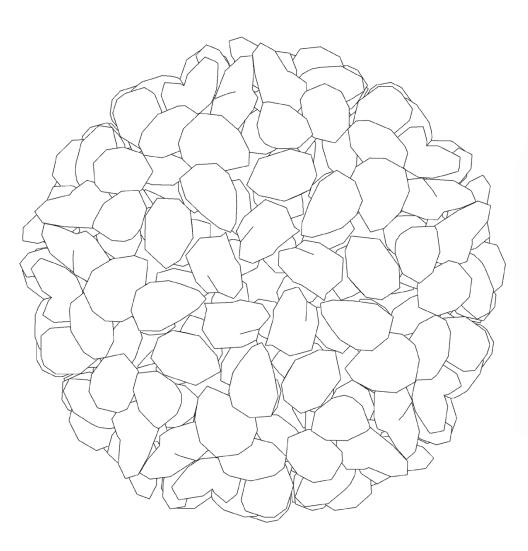
Tobacco Mosaic Virus

A cylindrical arrangement of proteins protects a long strand of RNA in TMV



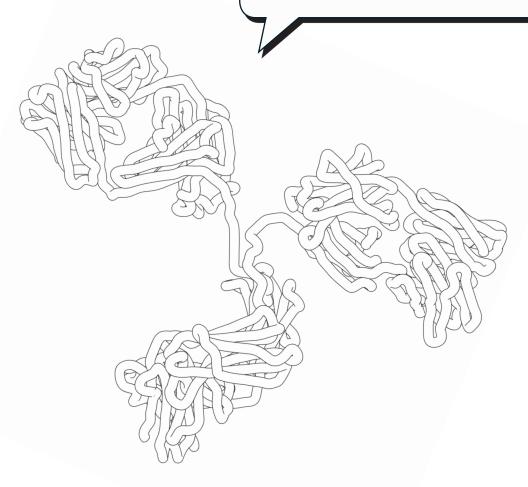
Poliovirus

Poliovirus can spread to the nerve cells that control muscle motion, causing paralysis



Antibodies

Antibodies search for foreign molecules like poliovirus in the blood. Polio vaccines tell cells of immune system to produce antibodies that prevent infection, and have been effective in limiting the spread of this disease.

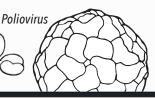




Structures studied by crystallography help us visualize cellular scenes

Blood plasma (top) and the red blood cell (bottom) shown at left include many molecules highlighted in this book:

Antibody (



Hemoglobin

Learn More

American Crystallographic Association:

amercrystalassn.org

PDB-101:

pdb101.rcsb.org

References

Access SMALL
MOLECULES at CCDC
ccdc.cam.ac.uk/structures
with these CSD refcodes:

Sucrose: **SUCROSO8**Caffeine: **NUTPEZ**Adenosine: **ADENOSO1**

Read Molecule of the Month articles about each of these proteins at pdb101.rcsb.org Access LARGER

BIOMOLECULES at RCSB PDB

rcsb.org
with these IDs:

Designed DNA crystal: **3gbi**Myoglobin (only heme

shown): **1a6m** DNA: **1bna** Insulin: **4ins**

Hemoglobin: **4hhb** New Delhi Metallo-Beta-Lactamase: **4eyl** Rubisco: **1rcx**

Tobacco Mosaic Virus: **2tmv**

Poliovirus: 1hxs Antibody: 1igt

Credits

This book was created by RCSB PDB members David S. Goodsell, Brian Hudson, Maria Voigt, and

Christine Zardecki

Molecular images created using UCSF Chimera, Ortep-3, and JSmol.

